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THE WHITE HOUSE
WASHINGTON

CABINET AFFAIRS STAFFING MEMORANDUM

Date: May 18, 1987 **Number:** 490, 657 **Due By:** -----

Subject: DOMESTIC POLICY COUNCIL MEETING - May 20, 1987, 2:00 p.m. in the Roosevelt Room.

	Action	FYI
ALL CABINET MEMBERS	☐	☐
Vice President	☑	☐
State	☑	☐
Treasury	☑	☐
Defense	☐	☐
Justice	☑	☐
Interior	☑	☐
Agriculture	☑	☐
Commerce	☑	☐
Labor	☐	☐
HHS	☑	☐
HUD	☑	☐
Transportation	☑	☐
Energy	☑	☐
Education	☑	☐
Chief of Staff	☑	☐
OMB	☑	☐
UN	☐	☐
USTR	☑	☐
CIA	☐	☐
EPA	☑	☐
GSA	☐	☐
NASA	☐	☐
OPM	☐	☐
SBA	☐	☐
VA	☐	☐

	Action	FYI
CEA	☑	☐
CEQ	☑	☐
OSTP	☑	☐
______	☐	☐
______	☐	☐
______	☐	☐
______	☐	☐
Carlucci	☑	☐
Cribb	☑	☐
Bauer	☑	☐
Dawson *(For WH Staffing)*	☑	☐
______	☐	☐
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______	☐	☐
Executive Secretary for:		
DPC	☑	☐
EPC	☐	☑
______	☐	☐
______	☐	☐
______	☐	☐
______	☐	☐
______	☐	☐

REMARKS:

The Domestic Policy Council will meet on Wednesday, May 20, 1987 at 2:00 p.m. in the Roosevelt Room to discuss Stratospheric Ozone.

A background paper is attached for your review.

RETURN TO:

☑ **Nancy J. Risque**
Cabinet Secretary
456-2823
(Ground Floor, West Wing)

☐ **Associate Director**
Office of Cabinet Affairs
456-2800
(Room 235, OEOB)

THE WHITE HOUSE

WASHINGTON

May 18, 1987

MEMORANDUM FOR THE DOMESTIC POLICY COUNCIL

FROM: ROBERT W. SWEET, JR.
Deputy Executive Secretary

SUBJECT: Domestic Policy Council Meeting of May 20

Attached are an agenda and materials for the Domestic Policy Council meeting scheduled for Wednesday, May 20, 1987 at 2:00 p.m. in the Roosevelt Room. The agenda item for discussion is stratospheric ozone.

The Council will be briefed on international negotiations now underway, and problems associated with reducing depletion of stratospheric ozone. Guidance will be sought from the Council on U.S. positions for various aspects of the problem. A paper containing background information and a summary of the issue areas is attached.

Attachment

THE WHITE HOUSE

WASHINGTON

DOMESTIC POLICY COUNCIL

Wednesday, May 20, 1987

2:00 p.m.

Roosevelt Room

AGENDA

1. Stratospheric Ozone -- Ambassador Richard E. Benedick
   Deputy Assistant Secretary,
   Environment, Health & Natural Resources
   Department of State

THE WHITE HOUSE

WASHINGTON

May 18, 1987

MEMORANDUM FOR THE DOMESTIC POLICY COUNCIL

FROM: THE ENERGY, NATURAL RESOURCES & ENVIRONMENT WORKING GROUP

SUBJECT: Stratospheric Ozone Protocol Negotiations

Issue - What should the U.S. negotiating position be for elements of the protocol to protect the stratospheric ozone layer by controlling emissions of ozone-depleting substances [chlorofluorocarbons (CFC) and halons]?

Background - The Environmental Protection Agency, under terms of a court order resulting from a lawsuit by the National Resources Defense Council against the EPA Administrator, must publish in the Federal Register by December 1, 1987, a proposed decision on whether there is a need need for further domestic regulations, under the Clean Air Act, of chemicals which deplete the stratospheric ozone layer. These chemicals [certain chlorofluorocarbons (CFCs) and halons] are used for solvents, refrigerants, foam blowing, fire extinguising agents, sterilants, aerosol propellants, and other miscellaneous uses.

Compared to other environmental laws, the Act sets a low threshhold for required action by EPA. Because of the global nature of the problem of ozone depletion, however, unilateral U.S. regulatory action would not be effective in protecting the ozone layer. An important U.S. objective in attaining an early and effective international agreement on ozone is also to avoid disadvantages to U.S. industry resulting from unilateral U.S. action required by the Clean Air Act.

The U.S. has been participating in international negotiations since 1983 on this subject, leading to the 1985 Vienna Convention on Protection of the Ozone Layer. Negotiations on a protocol to this Convention resumed in December, 1986, following intensive international scientific and economic assessments. Since December, there have been two further sessions, in February and April, 1987, and the protocol is scheduled for signing in September, 1987 in Montreal.

The objectives for the U.S. Government are in State Department Circular 175 of November 28, 1986. These objectives include:

(a) a near-term freeze on the combined emissions of the most ozone-depleting CFC and halon substances;

(b) long-term scheduled reduction of emissions of these chemicals down to the point of eliminating emissions from all but limited uses for which no substitutes are commercially available (could be as much as 95%), subject to (c); and

(c) periodic review of the protocol provisions based upon regular assessment of science, technology, environmental and economic (STEE) elements, which could remove or add chemicals, or change the schedule or the emission reduction target.

The Working Group on Energy, Natural Resources and the Environment has considered the issue of stratospheric ozone depletion over the past several months. Attached is a paper prepared by OMB that summarizes the available scientific, environmental, economic, and international data.

Discussion - Since the negotiations are now reaching a stage where final positions are being proposed, and due to the broad economic impact of these positions, several Cabinet agencies have asked that the Domestic Policy Council review the U.S. position and give guidance to the U.S. negotiating team on several elements of our position prior to the next negotiations.

Representatives of key countries, including the U.S., will meet on June 29 and at subsequent sessions to discuss a suggested text (attached) for a control schedule prepared by the Chairman of the April negotiation sessions (referred to as the Chairman's text). At that time they will address the chemicals to be covered, the timing and stringency of the controls, and the relationship of scientific assessments to this process. Following these meetings, the Council will be informed, and asked for further guidance on the U.S. final position prior to the formal negotiating meeting on September 8, 1987, and a ministerial endorsement meeting September 16-20, 1987.

DPC Guidance - General DPC guidance is sought on the following issues:

1. Chemical Coverage

-- The U.S. objective is to achieve the broadest coverage of major ozone depleters on a weighted basis, including fully halogenated CFCs and halons.

-- The European Community, Japan, and the USSR wanted only CFC 11 and 12 covered; but now may agree that CFC 113, 114, 115 and halons could be included if UNEP, in its June meeting, agrees that the Convention can include them.

-- Options include seeking differential coverage, i.e. reducing some and only freezing others. There is support for freezing but not reducing halons, given its defense uses.

-- There is general interagency agreement on chemical coverage. The negotiating team will press for the broadest attainable coverage in the freeze, subject to DPC guidance.

2. Stringency and Timing of Controls; Relationship to Periodic Assessments

-- Key issues are:

  o Stringency: Should there be an initial freeze and subsequent reductions? What should the reduction levels be, and in what timing and increments? What would be the probable effect on the ozone layer?

  o Timing: There are environmental benefits for early action to reduce CFC's; further, it would encourage industry to develop CFC substitutes. Given that a required reduction is likely, there is a need to provide time for industrial product development adjustment. Some in industry prefer a definite decision and advance notice. This conflicts with those who prefer to delay positive action as long as possible.

  o Relationship to periodic reassessments of scientific, technological, environmental and economic (STEE) factors scheduled in the protocol: Should we go for (1) planned reductions subject to reversal by vote of parties after reassessment, or (2) target levels to be implemented only by positive vote after reassessment, or (3) no targeted reductions?

-- The Chairman's text, released after the last negotiating session in April 1987, represents a possible emerging international consensus and is a convenient vehicle for review. It includes:

  o Freeze at 1986 levels of production/consumption of CFC 11, 12, 113, [114, 115] within two years after entry into force (EIF) of the protocol. This could happen in 1988, but the most likely EIF date is 1990.

  o An automatic 20% reduction 4 years after EIF. Likely date 1994.

  o Additional 30% reduction, to be implemented after scheduled STEE reassessment, with two options:

    (1) 6 years after EIF (likely date 1996), if positively confirmed by majority vote of parties, or

(2) 8 years after EIF (likely date 1998), unless reversed by two-thirds vote of parties.

- Additional steps down to possible eventual elimination of these chemicals for all but limited uses would be decided subsequently by parties based on periodic reassessments.

Questions for Decision: Should U.S. delegation seek agreement along lines of chairman's text, work for greater stringency/earlier impact, or propose some relaxation in terms?

(a) Freeze. Interagency accord, within 1-2 years of EIF. Some prefer an earlier freeze.

(b) 20% reduction. Some agencies feel implementation should require positive vote of parties following a STEE reassessment in 1990.

(c) Additional 30% reduction. There is interagency disagreement here on several elements.

-- Should a set level of reduction beyond the first 20% be scheduled; if so, at what level?

-- Should a second reduction be 6 years after EIF and be subject to a positive vote, or be 8 years after EIF and be subject to a reversal vote, or some other variant?

(d) Additional reduction steps. Should the delegation press for further reductions as contained in the Chairman's text and Circular 175? If so, at what levels and time frame? Should they require a positive vote or be implemented unless there is a vote for reversal? Alternatively, should the process for setting reductions and timing be specified? Anything beyond the Chairman's text may not be achievable.

3. Control Formula and Trade Provisions:

(A) Trade Among Parties.

Significant differences remain among governments over a formula for regulating controlled chemicals.

- Options include national ceilings on: (a) production; (b) production plus imports, combined or separately; (c) consumption; or, (d) production plus imports, less exports to parties, less amounts destroyed.

- o There is general interagency agreement favoring a ceiling on consumption, or "adjusted production," but compromise may be needed.

- o U.S. objectives include effective control of emissions with accountability, fewest restriction on the flow of trade and captial among parties, and most favorable formula for U.S. industry. Verification remains an issue.

- o Subject to DPC guidance, the delegation will pursue these objectives and seek DPC approval of specific recommendations at a later time.

(B) <u>Trade With Non-Parties</u>.

-- Key elements:

- o General international consensus on:
  - -- Ban on imports of controlled chemicals in bulk from non-parties.
- o No international consensus on:
  - -- Restrictions on exports of bulk chemicals.
  - -- Restrictions on imports of products containing controlled chemicals.
  - -- Consideration of restrictions on products made with controlled chemicals.
  - -- Consideration of restrictions on export of technology and equipment.

-- U.S. objectives: to regulate trade in order to encourage adherence to protocol and avoid benefits to non-parties at expense of parties. Proposals consistent with GATT.

-- Interagency consensus in favor of strong trade article, including trade in bulk chemicals and products that could be uniformly enforced. Transfer of technology and equipment remains an issue.

-- Subject to DPC guidance, delegation will pursue these objectives and seek DPC approval of specific recommendations at a later time.

4. <u>Participation</u>.

-- U.S. objective: To encourage effective global control through widest possible participation by other countries.

-- **Problem:** The less developed countries (LDCs) need concessions for essential domestic uses to encourage adherence; but exemptions must remain limited to avoid undercutting global control levels. Concessions being considered in the Chairman's text could double global production ceiling if fully used within the period allowed.

-- One option entails exemption from controls for a limited period for LDCs followed by adherence to the protocol. Controls will be needed to restrict production in the LDCs by existing producers.

-- Related problem: Majority LDC membership could control protocol voting to U.S. disadvantage. Should U.S. press for weighted voting based on historic use and production levels? Should elements be put into the protocol?

-- This issue needs more work. Subject to DPC guidance, we will refine our objectives for subsequent negotiations and later seek DPC approval of specific recommendations.

CHAIRMAN'S TEXT

Distr.
RESTRICTED

UNEP/WG.172/CRP.8/Rev.1
30 April 1987

Original: ENGLISH

Ad Hoc Working Group of Legal and Technical Experts for the Preparation of a Protocol on Chlorofluorocarbons to the Vienna Convention for the Protection of the Ozone Layer (Vienna Group)

Third Session
Geneva, 27-30 April 1987

TEXT PREPARED BY A SMALL SUB-WORKING GROUP OF HEAD OF DELEGATIONS

ARTICLE II: CONTROL MEASURES

1. Each party, under the jurisdiction of which CFC 11, CFC 12, CFC 113, (CFC 114, CFC 115) are produced shall ensure that within (2) years after the entry into force of this Protocol the (combined annual production and imports) (combined adjusted annual production) of these substances do not exceed their 1986 level.

2. Each party, under the jurisdiction of which substances referred to in paragraph 1 are not produced at the time of the entry into force of this Protocol, shall ensure that within (2) years from the entry into force of this Protocol (its combined annual production and imports) (its combined adjusted annual production) do not exceed the levels of imports in 1986.

3. Each party shall ensure, that within (4) years after the entry into force of this Protocol levels of substances referred to in paragraph 1 attained in accordance with paragraphs 1 and 2 will be reduced by 20 per cent.

4. Each party shall ensure that within (6) (a), (8) (b) years after the entry into force of this Protocol, the 1986 levels of substances referred to in paragraphs 1 and 2 will be further reduced (by 30 per cent), (a) (if the majority of the parties so decide, (b) (unless parties by a two-third majority otherwise decide), in the light of assessments referred to in Article III, such decision should be taken not later than (2) (4) years after entry into force.

5. Parties shall decide by (two-third majority) (a majority vote)

- whether substances should be added to or removed from the reduction schedule
- whether further reductions of 1986 levels should be undertaken (with the objective of eventual elimination of these substances).

These decisions shall be based on the assessments referred to in Article III.

<u>Note</u>: A second paragraph reading as follows has to be added to Article III. Beginning 1990, and every four years thereafter, the parties shall review the control measures provided for in Article II. At least one year before each of these reviews, the parties shall convene a panel of scientific experts, with composition and terms of reference determined by the parties, to review advances in scientific understanding of modification of the ozone layer, and the potential health, environmental and climatic effects of such modification.

BACKGROUND FACTS OZONE ISSUE

THE DEPLETION MECHANISM

Man-made chlorofluorocarbons (CFC's) and halons are compounds widely used in industrial economies. Their lifetimes in the atmosphere are expected to be 75 - 100 years. Eventually, they are transported into the stratosphere and broken apart, by ultraviolet light (UV), into oxides of chlorine and bromine. These act as catalysts, each molecule breaking apart thousands of ozone molecules. The reduction of ozone transmits more UV to the surface.

NUMERICAL PREDICTIONS OF DEPLETION

Chart 1 shows projected depletions for a range of CFC emissions.

Even when predicted changes in total ozone in the column are small and little change occurs in UV reaching the surface, major changes in the vertical distribution of the ozone are still predicted with a potential net warming effect on the climate.

HOW GOOD ARE THE NUMERICAL MODELS

The models are in some conflict with empirical measurements. Measured ozone abundances above 35 km. exceed modeled abundances by as much as 30-50 percent. There are also errors in predicted temperatures, in distributions of odd nitrogen species and other atmospheric chemicals and in model sensitivity to chlorine.

On the other hand, all of the models predicted, within acceptable limits, similar ozone depletions for given CFC scenarios.

ACTUAL TRENDS IN OZONE

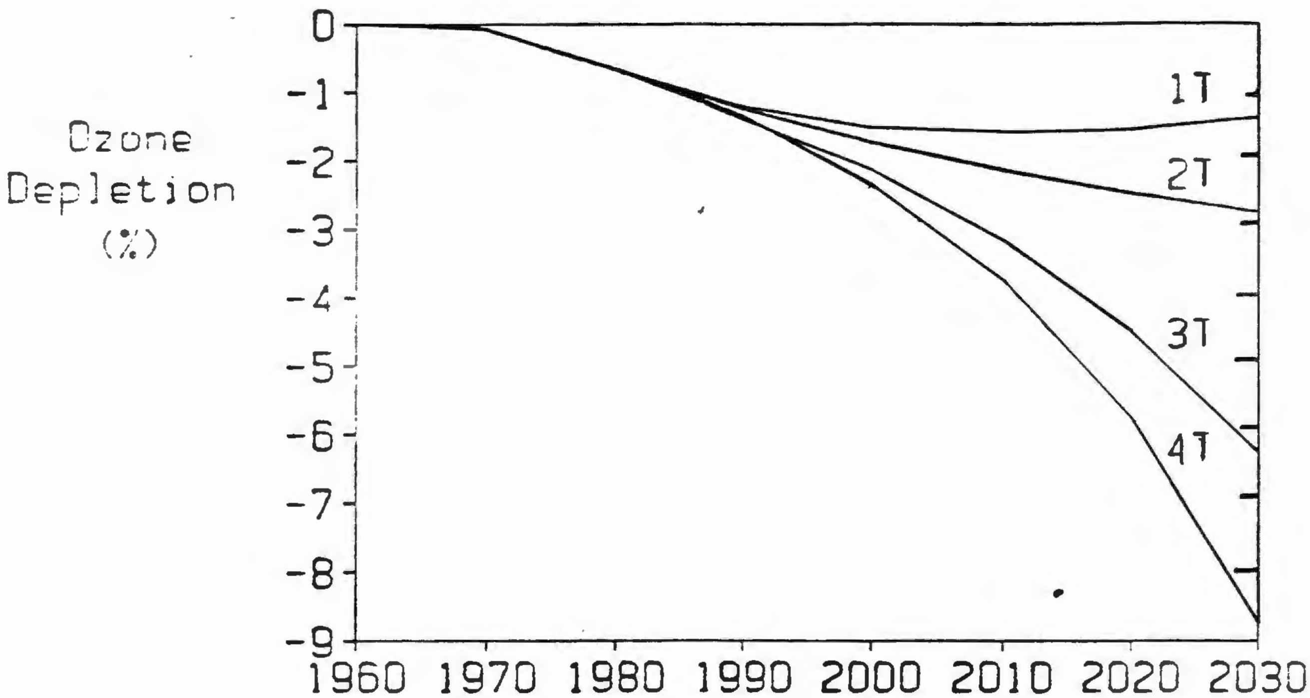
Monitoring efforts to measure actual trends in global ozone have produced inconsistent and inconclusive results. Ground-based "Dobson" instruments, in use since 1960 at dozens of stations, show no trend in ozone abundance. A much smaller number of "Umkehr" stations, in use since 1970, and satellite data taken since 1978 show significant decreasing trends in the total ozone column, largely since 1981. Whether the apparent trends are due to satellite sensor-drift, the El Chichon eruption, the 1982 El Nino, changes in solar radiation, or manmade CFC's is not certain. A detailed re-evaluation of these sources of data will be available in late fall, 1987.

In short, interpretations of the existing satellite and ground-based data on ozone trends range from:

- -- No obvious human-caused trends, to
- -- Marked downward trends, 2-3X larger than predicted by theory.

Chart 1

Time Dependent Globablly and Seasonally Averaged Changes in Ozone for Coupled Perturbations (IS 2-D Model)



Results show for four scenarios of trace gas growth:

Scenario	CFC-11 and CFC-12
1T	1980 levels
2T	1.2% growth
3T	3.0% growth
4T	3.8% growth

Assumptions for other trace gases are the same in each scenario: constant emissions of CFC-113, CCl4, and CH3CCl3, zero emissions of halons, one percent growth per year in CH4, and 0.25 percent growth per year in N2O. CO2 concentrations grow at 0.5 percent.

Source: Stordal and Isaksen, (1986).

THE ANTARCTIC OZONE "HOLE"

It was discovered in 1985 that, since about 1965, in the Antarctic spring, and only in the spring, overhead ozone has increased in a ring around, and decreased directly above Antarctica. This seasonally temporary depletion has been more and more each year and now amounts to 40-50 percent of the ozone, approximately offset by the build-up in the ring. It was totally unanticipated by the existing science and models.

The global implications, if any, of the "hole" are currently unknown since the cause is not established. The existing observations could be consistent with but are not proof of the man-made chlorine hypothesis.

EFFECTS OF OZONE DEPLETION

Ozone depletion has a number of potential adverse impacts as follows. Except possibly for skin cancer, the level of depletion needed to cause significant adverse effects is unknown.

Skin Cancer Effects. Prolonged sun exposure is considered to be the dominant risk factor for non-melanoma skin tumors. However, uncertainty exists in the actual doses received by populations and in the changes in response which would result from changes in dose. Changes in behavior have tended to increase skin cancer incidence and mortality, which, therefore, could be reduced by changes in behavior.

In the U.S. there are more than 400,000 non-melanoma skin cancer cases each year with about 4000 deaths. Table 1 shows the range of estimates of increase from a 2 percent depletion for San Francisco. Worldwide growth of CFC emission of 1 percent annually is estimated to cause a 2 percent depletion by about the year 2010.

Table 1.

Type	Current Cases, %	Current Deaths, %	Increase in Incidence, % Male	Female
Basal Cell	71	20-25	2.1 - 7.2	0.7 - 5.0
Squamous Cell	29	75-80	3.2 - 11.7	3.1 - 13.3

The non-melanoma skin cancer effects of ozone depletion are not likely to be given great weight in developing countries wishing to use CFC's -- skin pigmentation is a protective barrier that reduces the incidence of such tumors.

Much circumstantial evidence implicates solar radiation as one of the causes of cutaneous malignant melanoma (CMM), with 25,000 cases and 5,000 deaths in the U. S. in 1985. On the other hand, some studies find no correlation between incidence and latitude, and outdoor workers have lower CMM rates than indoor workers.

EPA's estimate is that each 1 percent ozone depletion would increase incidence by 1-2 percent and deaths by 0.8-1.5 percent.

Immune System Effects. Solar radiation has been found to have a detrimental effect on the immune system of both humans and animals. Although the mechanisms are not fully understood, it is clear that the UV part of the spectrum, which is screened out by ozone, is responsible.

Plant Life Effects. Existing knowledge of the risks to crops and terrestrial ecosystems from ozone depletion is extremely limited.

Data for crop species, although incomplete and often not from field studies, suggest that large variations exist within species for response to UV. For example, in 3/4 of soybean cultivars tested, levels of UV simulating 16-25 percent ozone depletion reduced yields by up to 25 percent with quality reductions.

Little or no data exists for trees, woody shrubs, vines, or lower vascular plants. Increased UV could alter competition in natural ecosystems unpredictably.

Aquatic Life Effects. Experiments show that UV causes damage to fish larvae and juveniles, shrimp and crab larvae, and to plants essential to the aquatic food web. Enhanced UV would probably change the composition of marine plant communities and could cause unpredictable changes to aquatic ecosystems.

Current data is very incomplete and limited. Understanding of aquatic organism lifecycles and of aquatic ecosystems is very limited. Great uncertainty exists about effects because UV attenuation in the water column is variable and organism behavior can affect dosage.

Climate Changing Effects. CFC's, like CO_2, are greenhouse gases, but more powerful by a factor of 10,000. Increasing concentrations contribute to global warming.

CFC's IN U. S. INDUSTRY

Use of CFC's in the U. S. is spread among seven use categories and a large number of applications.

Table 2

Use Category	1985 Use (Metric Tons)	Percentage of Ozone Depleting Potential
Solvents	41,369	14
Refrigeration	78,987	28
Foam Blowing	70,430	28
Fire Extinguishing	6,250	20
Sterilization	12,133	4
Aerosol Propellants	8,000	3
Other Miscellaneous	7,083	3

COSTS OF EMISSION REDUCTION

EPA has done a preliminary analysis of possible actions to reduce CFC compound use in the short (shown below), medium, and long term:

Table 3

Cost/Kilogram Reduced	Percent Reduction in Use (Weighted by Ozone Depleting Potential)
Short-term:	
<$0.15	30
$0.15 to <$2.30	5
$2.30 and more	16
Short-term total	61

CHEMICAL SUBSTITUTES FOR CURRENTLY USED CFC's

The industry is looking at several possible compounds which could be sustituted for current CFC's. The minimum time frame to introduce such susbstitute products into commercial use would be 5-10 years. For the following reasons, it is likely to be closer to 10:

- -- Publicly known production processes are low in yield with large waste streams that are partly toxic and partly recyclable. Long-term (3-4 years) toxicology tests will probably not be done until the process that will be used is defined and optimized.
- -- Potential producers may not commit to a process until they are reasonably sure that better ones don't exist.
- -- Commercial users may insist upon completion of toxicology testing before adopting new compounds.
- -- Users would also need a period for product compatibility/performance testing and for any product and process redesign.
- -- Producers would need time to design and build full scale plants.

Dupont has published estimates that substitutes are likely to have a cost that is 2-5 times that of current CFC's. However, for most uses, the cost of CFC's is a very small part of the total cost of the final product. Dupont estimates that 5-6 years would be needed to bring substitute compounds to the commercial market place, not including time for customers to shift to the new products.

One industry estimate of future U. S. CFC consumption estimates that a freeze would cause a real price increase of 2-3 times within the first 3 years and 4 times beyond 7 years. EPA and others argue that a freeze would not bring in substitute compounds in the short-term, because alternatives would prevent a sufficient price increase unless a 50 percent or greater reduction in use were imposed.

CFR CONTROL MUST BE GLOBAL

U. S. use of CFC's is 27 percent or world use and is not large enough that U. S. action alone can significantly affect long term emissions. Under the Clean Air Act, EPA must consider unilateral action even though it would not be as effective as global action.

CONTROL IN U.S. IS MORE DIFFICULT - AEROSOLS ALREADY BANNED

Patterns of use in the U.S. and in other non-communist reporting countries are significantly different. Other country use is 2 times U.S., Canada, and Sweden banned non-essential aerosol use in 1975, using available substitutes.

Some observers have argued that the U. S. position should be for equal percentage reductions in use after the elimination of non-essential aerosol use. Others argue that approach is very unlikely to be acceptable to countries with unrestricted aerosol use.

COSTS AND BENEFITS

CEA believes that given the projections of ozone depletion and estimates of the health consequences assuming no behavorial changes, it is possible to asess the economic benefits of the CFC control protocol presently under discussion. EPA's risk assessment indicates that the freeze + 20 percent cutback will avoid approximately 992,900 deaths in the U.S. from skin cancer among people alive today and those born through 2075. An additional 30 percent cutback will save an additional 78,700 lives. The economic benefit of saving these lives, under standard assumptions for valuation of statistical lives saved and discounting of future values, is very large, on the order of hundreds of billions.

These benefits, which do <u>not</u> include non-health benefits or benefits from avoidance of non-fatal skin cancers and cataracts, are much larger than the costs of control estimated by industry or EPA. Industry has estimated that the cost of a freeze to the U.S. would be about $1 billion cumulatively between now and the year 2000. EPA has estimated that the cost of a 30 percent reduction in the controlled substances would be about $3-$4 billion cumulatively between now and the year 2000.

OZONE - CHLOROFLUOROCARBONS (CFCs)

BROAD SCIENCE OVERVIEW

- TRACE GASES:
  - THE ATMOSPHERIC CONCENTRATIONS OF CFCs, CO_2, CH_4, AND N_2O ARE ALL INCREASING RAPIDLY ON A GLOBAL SCALE
  - THESE GASES ALL PREDICTED TO CHANGE OZONE
- OZONE MEASUREMENTS:
  - 90% OZONE RESIDES BETWEEN 15- AND 50 km ALTITUDE
  - 30 YEAR RECORD FOR COLUMN OZONE
  - 2-3% NATURAL VARIABILITY OVER DECADE
- OZONE MODELING:
  - MODELS DESCRIBE TODAY'S ATMOSPHERE QUITE WELL
  - LONG-TERM PREDICTIONS LESS CERTAIN DUE TO UNCERTAINTIES IN FUTURE ATMOSPHERIC CONCENTRATIONS OF CO_2, CH_4, AND N_2O

OZONE - CHLOROFLUOROCARBONS (CFCs)

CONCERNS

- TOTAL OZONE —UVB-RADIATION: HUMAN HEALTH, ECOSYSTEM PRODUCTIVITY

- VERTICAL DISTRIBUTION OF OZONE: TEMPERATURE, CIRCULATION, CLIMATE

- OZONE RESPONDS TO THE TOTAL ATMOSPHERIC BURDEN OF CHLORINE AND BROMINE

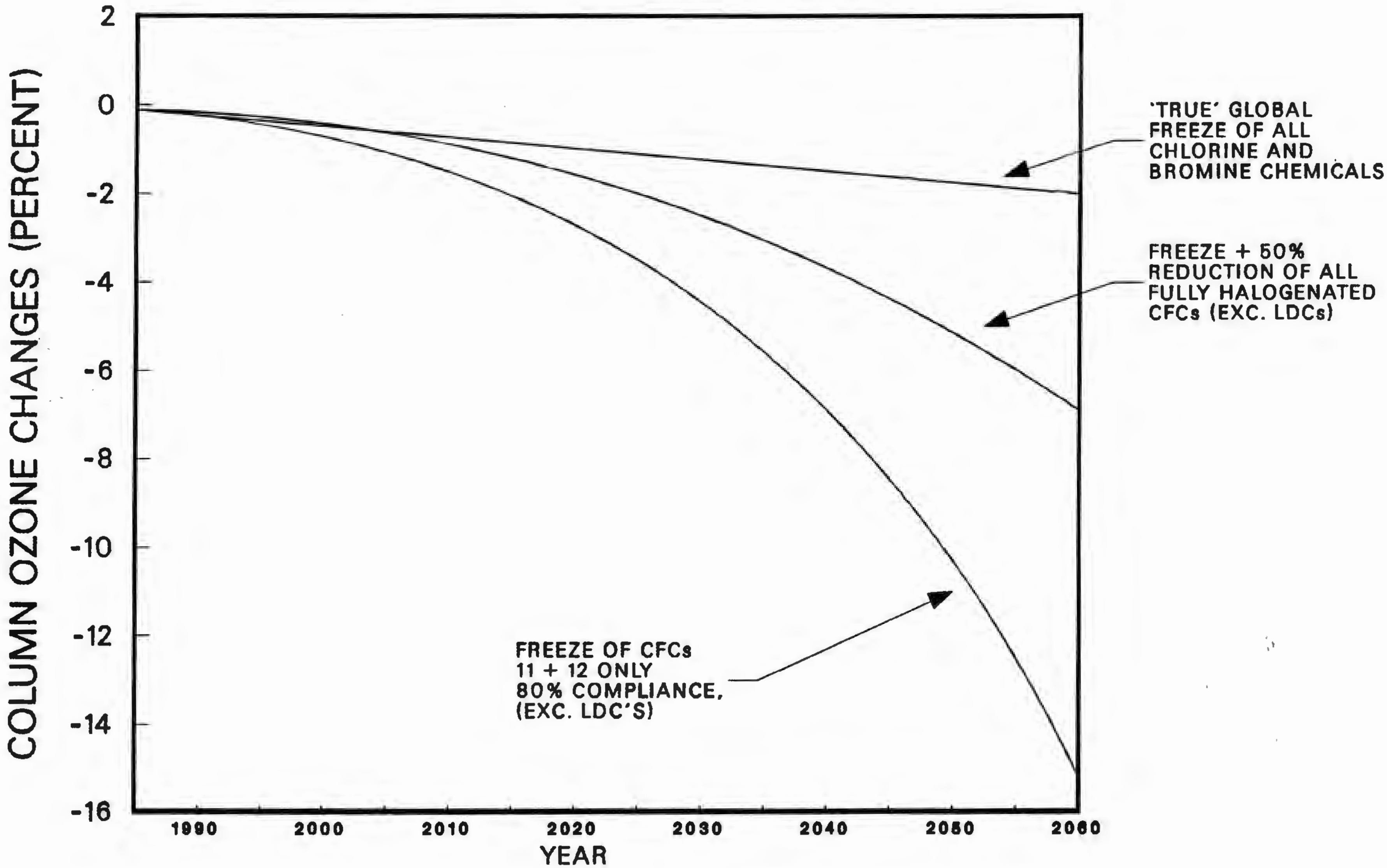
- FULLY HALOGENATED CHEMICALS OF CONCERN: CFC-11, CFC-12, CFC-113, CFC-114, CFC-115, H-1301, H-1211

- ATMOSPHERIC LIFETIMES FULLY HALOGENATED ~ 100 YEARS

- ENVIRONMENTAL RECOVERY WILL TAKE DECADES TO CENTURIES

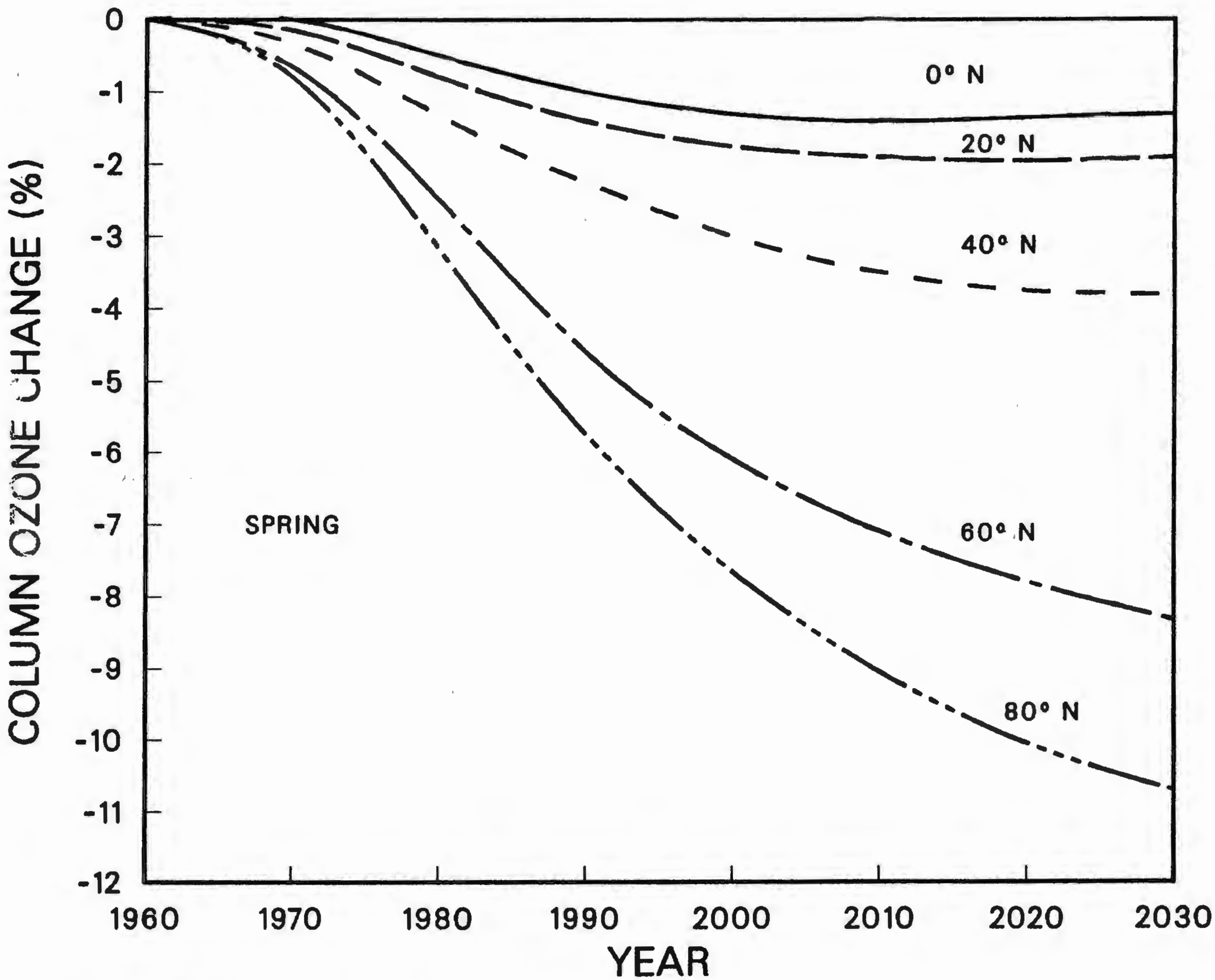
- PARTIALLY HALOGENATED CFCs, e.g. CFC-22, ARE 20 TIMES LESS EFFICIENT THAN THAN FULLY HALOGENATED CFCs AT DESTROYING OZONE.

PREDICTED GLOBAL OZONE DEPLETION



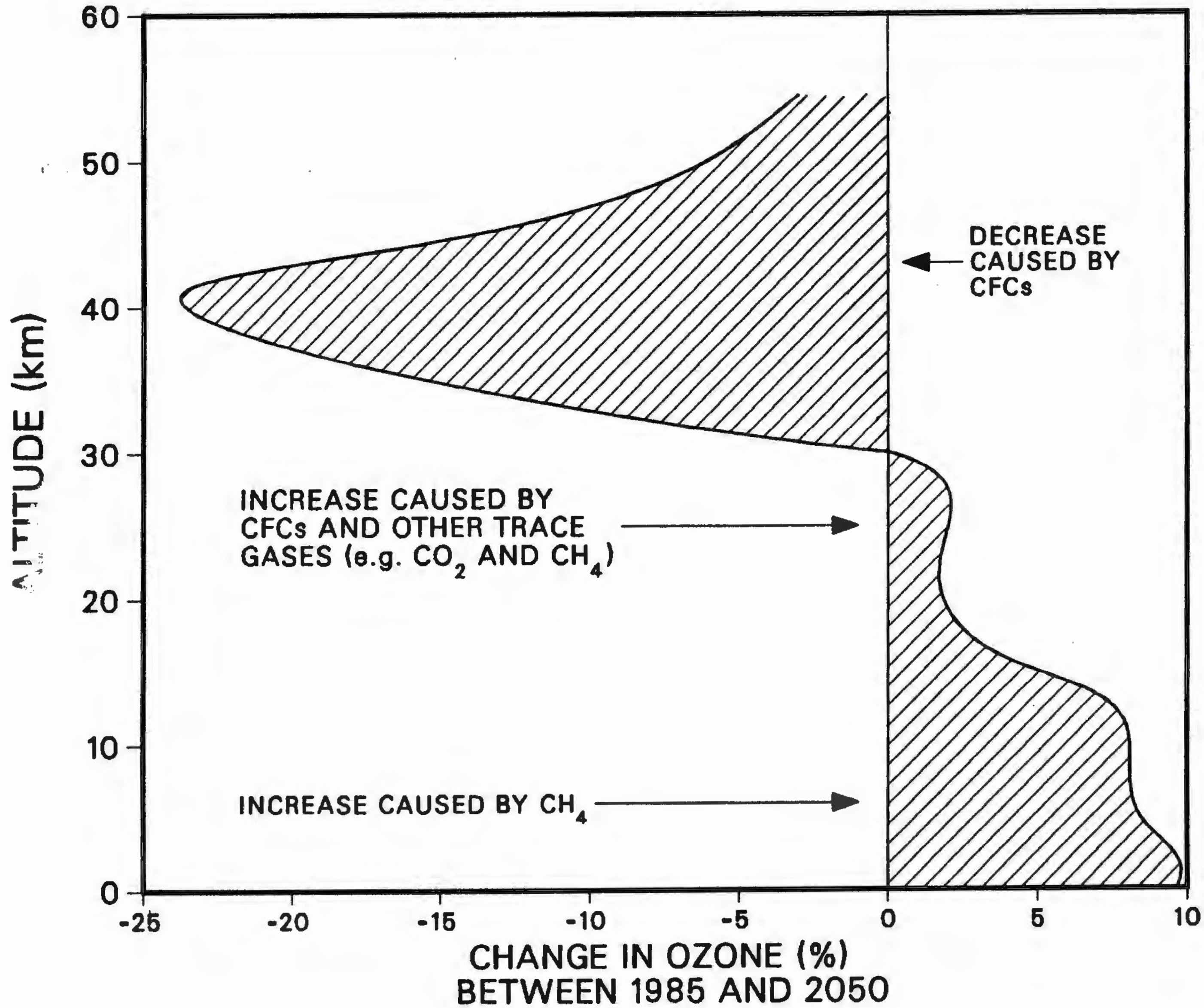
- LONG TERM PREDICTIONS SENSITIVE TO ASSUMPTIONS ABOUT FUTURE GROWTH RATES IN ATMOSPHERIC CFCs, CO_2 AND CH_4

CHANGES IN COLUMN OZONE AT DIFFERENT LATITUDES FOR A TRUE GLOBAL FREEZE

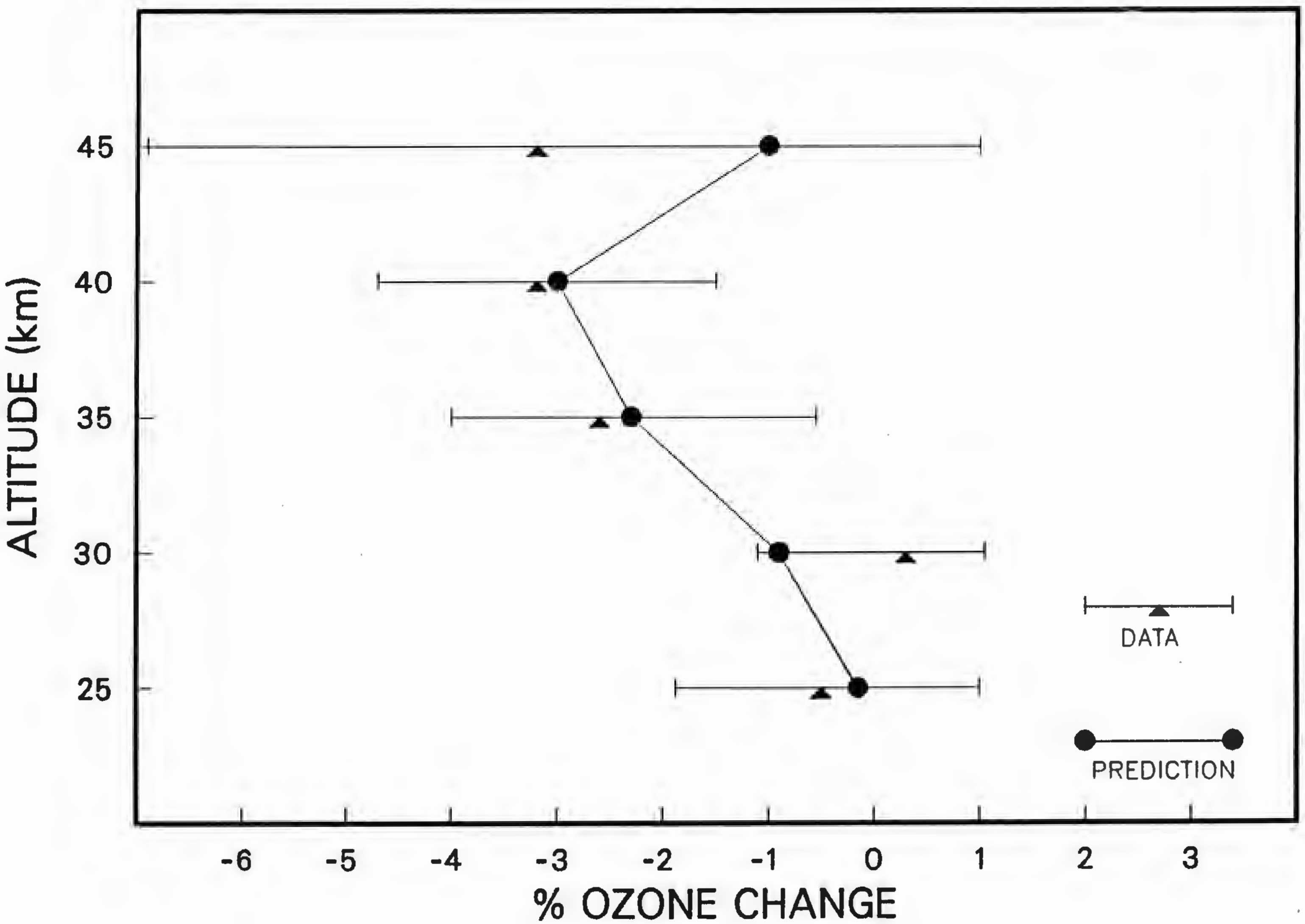


- ALL 2D MODELS PREDICT DEPLETIONS GREATER THAN THE GLOBAL AVERAGE AT HIGH LATITUDES, HENCE BASIS FOR CONCERN FROM SCANDANAVIANS, ETC.

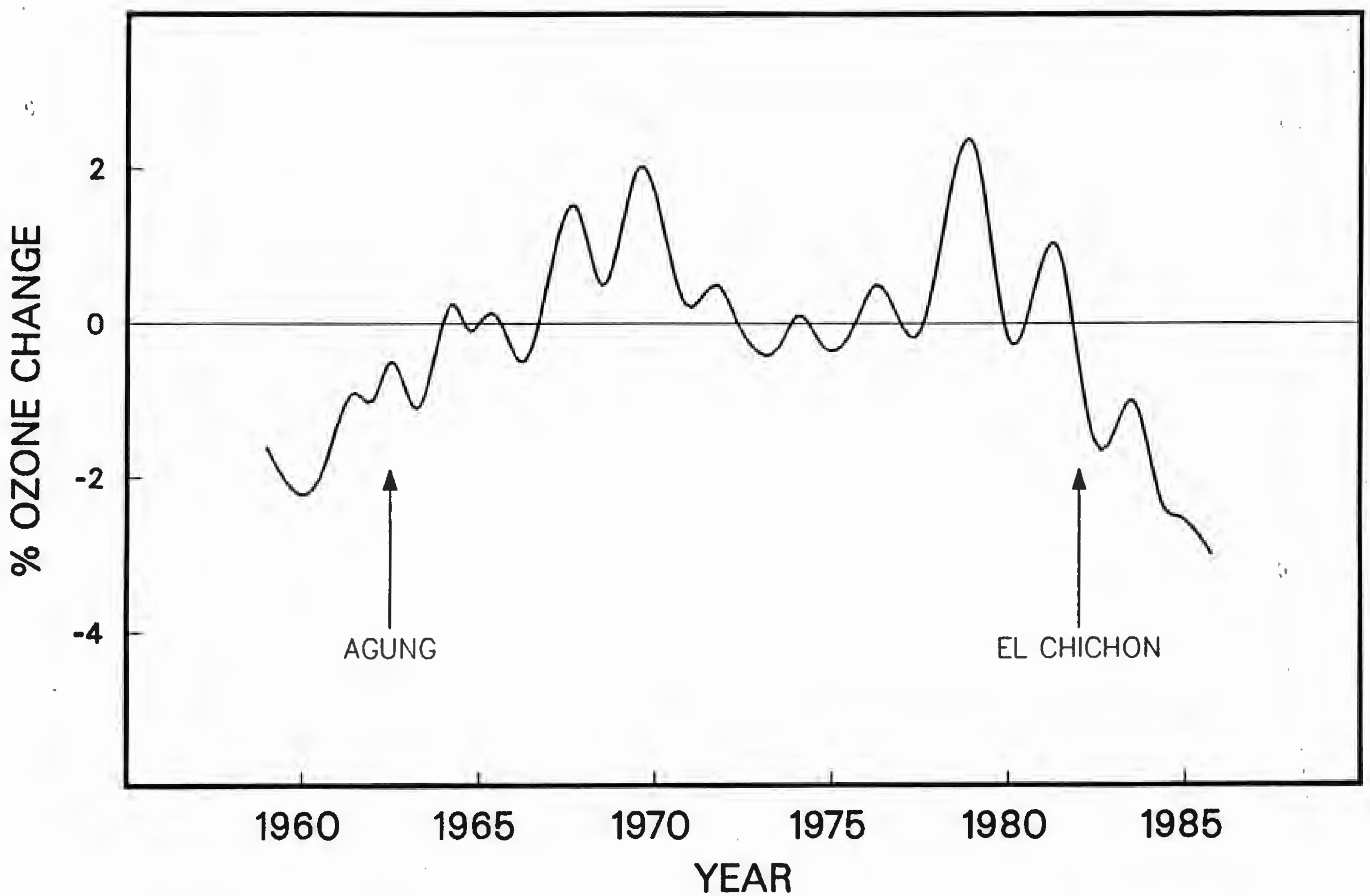
CHANGES IN OZONE DISTRIBUTION FOR A TRUE GLOBAL FREEZE OF ALL CFCs



GLOBAL OZONE MEASUREMENTS
VERTICAL OZONE DISTRIBUTION
DECADAL TREND 1970-1980



GLOBAL OZONE MEASUREMENTS
COLUMN OZONE



EFFECTS OF OZONE DEPLETION

EFFECT	STATE OF KNOWLEDGE	POTENTIAL GLOBAL IMPACT
SKIN CANCER	MODERATE-TO-HIGH	MODERATE
IMMUNE SYSTEM	LOW	HIGH
CATARACTS	MODERATE	LOW
PLANT LIFE	LOW	HIGH
AQUATIC LIFE	LOW	HIGH
CLIMATE IMPACTS	MODERATE	MODERATE
TROPOSPHERIC O_3, H_2O_2	MODERATE	LOW
POLYMERS	MODERATE	LOW

SKIN CANCER EFFECT OF 1% DECREASE IN OZONE

	PRESENT		*INCREASE FROM 2% INCREASE IN UV-B*		
SKIN CANCER	ANNUAL CASES	FATALITIES	INCREASE	CASES	DEATHS
MELANOMA	25,000	25%	1-2 %	250-500	60-125
NON-MELANOMA	500,000	1%	2-6 %	10,000-30,000	100-300

OZONE - CHLOROFLUOROCARBONS (CFCs)

FUTURE

- DATA BASE AND MODELING CAPABILITIES IMPROVING
- ANTARCTIC OZONE HOLE BETTER UNDERSTOOD
- REGULAR MAJOR SCIENTIFIC ASSESSMENTS ESSENTIAL

CONCLUSIONS

- **SCOPE :** ALL FULLY HALOGENATED CHLORINE AND BROMINE CHEMICALS
- **COMPLIANCE:** INTERNATIONAL AGREEMENT ESSENTIAL WITH MAXIMUM PARTICIPATION OF ALL NATIONS. GROWTH IN DEVELOPING COUNTRIES MUST BE CONSIDERED